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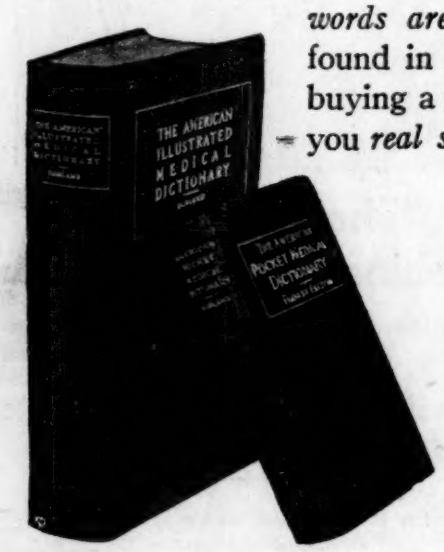

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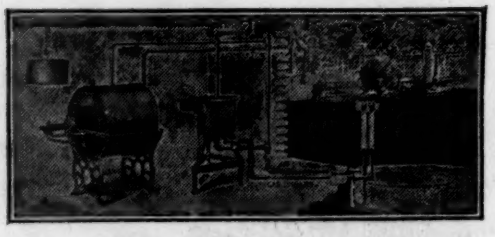

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UNIVERSITY IDEALS AND THEIR LIMITATIONS[1]

WHEN I was asked to address the "Forum," it was with a thrill of pleasure that I accepted, for I felt that this invitation would give me the opportunity of addressing the soul of the student body, for this student body has a youthful, forceful soul, where a clearly conceived and beautiful idealism aspires to adequate self-expression.

It may seem unnatural to some of you that I should find it possible to speak today upon a topic which has no *special* relation to the great war. In so doing, however, I have merely followed the example of Professor George Sarton, who so recently delighted and instructed us in his lectures on "The New Humanism," and my special reason for imitating this distinguished Belgian is that, whatever may be our part in the great struggle now in progress, our outlook on this or any other crisis must of necessity be from the point of view of university men, men whose acts are directed and whose thoughts are inspired by university ideals. It is therefore as imperative at this time as at any other to enquire into the natue of these university ideals, which have been our heritage from the past and form our background in the present and whose influence is none the less profound in that we are generally quite unconscious of its operation.

The terms "university" and "state university" are quite distinct. The institutions so named may have very little in

[1] Address delivered before "The Wisconsin Forum," January 20, 1918, at the University of Wisconsin.

common. A university is a postgraduate school devoted to the pursuit of truth regardless of its material usefulness. A state university may be only a college, by which I mean a sort of advanced high school. Thus the word "university" designates a distinct entity; while "state university" is a title of dignity.

Wherever there is a university there is also a tendency for the formation of other educational units, a college, professional schools, technical schools and art schools, and the name "university" tends to be stretched to cover all these. Whatever may be the original character of a state university, it tends to develop a postgraduate school after the model of the university and ultimately to comprise, in addition to this postgraduate school, a college, professional, technical and art schools. The formation of these large educational aggregates is a feature of the times. They are the results of economy and convenience.

Naturally the close association of several component institutions causes great modification in all of them through mutual interaction, so that we might expect to find the postgraduate school of a state university, like the University of Wisconsin for example, somewhat different from, let us say, the Johns Hopkins University in the eighties or Clark University at the present time. The degree and character of the development of the various constituent organizations which go to form such an educational aggregate as above referred to will depend largely upon the special causes which have brought the institution as a whole into being and those by which it is maintained.

From the foregoing and from the title of this address, "University Ideals," it might be expected that this discussion would concern itself with the ideals of an isolated post-graduate school. Strictly speaking this is not the case. For practical reasons, which I need not stop to enumerate, I shall discuss an institution where in addition to the work of the university proper, undergraduate teaching is carried on to at least a small extent.

It may be remarked, however, that although I speak specifically of science and the scientific, I *believe* that, *mutatis mutandis,* for example the substitution of the word "creation" for the word "discovery," the statements which I am about to make would apply to any component art or literary institution.

The ideals of a university concern its activity and its attitude. The former, as already stated, is the *pursuit of truth* regardless of its material usefulness and in so far as the college is concerned with the exposition of this truth to the undergraduates. The ideal attitude of the university is characterized by its being *agnostic* (a term which will be carefully defined later) and also what I shall designate for want of a better word *universal.* To a consideration of these we shall now turn our attention beginning with a discussion of the search for truth.

Guizot once said:

> Science has its sublime speculators who are, so to speak, its prophets who detect instantly the great laws of the universe and grasp them, as Columbus discovered the New World, hastening to the search in the faith of an idea. Around them are drawn up the sagacious observers who excel in searching out, establishing particular truths, describing them and uniting them successively to the domain of science. And into this domain so enriched enter the legislative minds who classify the facts received, note their relations and determine their laws, and transform them into those general formulas which define the present state of science and become the points of departure and the instrument of future conquests.[2]

[2]Quoted by E.-F. Dubois, "Eloges lus dans les séances publique de l'Academie de Médecine," II., p. 116.

Such is the activity of a university, always bearing in mind the fact that the "sublime speculators" are few and far between and that most of us while following the path laid down by them and enjoying the fruits of their genius must content ourselves with the study of lesser problems. To devote ourselves to such activity and then to return from time to time from expeditions into the unknown with our sack full of treasures which our enthusiasm loves to show to eager and inquiring students whose highest ambition is to follow us and to wrest from Nature the secrets which she in playful reluctance yields to us, is one of the keenest joys the intellect can experience.

But this very simile of an expedition carries with it this question, who is to pay for the expedition? Who is to fit out the ships of Columbus? Who is to endow our laboratories and our professional chairs? It is indeed an important fact that every researcher is dependent either directly or indirectly upon the bounty of some person or persons who may be called the patrons of learning and who, whether they be the people of the state or some smaller group, are always on the watch for what they deem adequate returns. It is only in heaven, where the pangs of hunger can not reach us, that there can exist such a condition as is described in the stanzas,

> No one shall work for money, and no one shall work for fame;
> But each for the joy of the working, and each in his separate star,
> Shall draw the Thing as he sees It, for the God of Things as They Are![3]

For all our pursuings of truth must sooner or later be endorsed by the patrons at whose expense we dine or at least lunch. Thus the range of activity of the university is limited not only by the intellectual shortcomings of the researchers themselves but by the attitude of the patrons. These persons, being only human, may be affected unfavorably, and therefore in the direction of limitation, by two factors, namely, their incapacities and their prejudices.

Of these the second, namely the prejudices, are the more potent if less conspicuous, and are also singularly resistant toward external, ameliorative influences. The mode of action of these prejudices is very familiar to us all. All are aware that no researcher whose results are offensive to the patrons can retain their support, for

> This same truth is a naked and open daylight, that doth not show the masks and mummeries and triumphs of the world half so stately and daintily as candlelights.[4]

We have but little reason to hope that this form of limitation may be relaxed through changes in the political order. We are too prone to believe and to assert that in a *real* democracy research of every sort will be encouraged and all truth will be welcome. This naïve over-confidence in democratic institutions is rudely shaken when we recollect that it was in the most intellectual and cultivated democracy that the world has ever known that Socrates was tried and convicted, "firstly of denying the gods recognized by the state and introducing new divinities, and secondly of corrupting the youths of Athens." Thus, although Athenian democratic society was eminently fitted to develop intellectual brilliancy, it was hostile to intellectual liberty and when brought into opposition to the dominant prejudice and dominant public opinion, the way of the innovator was hard.

There are few who would expect that a consideration of post-Athenian ways and customs would lead to encouraging comparisons.

[3] Rudyard Kipling, "L'Envoi" of "Seven Seas."

[4] Francis Bacon, "Essay on Truth."

Although the stigma of intolerance may cling to mankind forever there is a second factor which also limits intellectual freedom but which is capable of very great amelioration. This is the failure on the part of the patrons to appreciate the choicest fruits of scholarship and research.

It is more rare that a failure of appreciation leads to dismissal of a professor, but it is a matter of not unusual occurrence that persons whose vision is not easily followed are thwarted, nagged and otherwise actively encouraged to go somewhere else where the patrons are more enlightened.

As an example of this nagging which is none the less disagreeable for being unpremediated, I can not refrain from quoting a story, as realistic as it is imaginary. It is told by President Maclaurin, of the Massachusetts Institute of Technology, in his article on "Efficiency and Education":

> The superintendent of buildings and grounds, or other competent authority, calls upon Mr. Newton. *Superintendent:* Your theory of gravitation is hanging fire unduly. The director insists upon a finished report, filed in his office by 9 A.M. Monday next; summarized on one page; typewritten and the main points underlined. Also a careful estimate of the cost of the research per student hour.
>
> *Newton:* But there is one difficulty which has been puzzling me for fourteen years and I am not quite . . .
>
> *Superintendent* (with snap and vigor): Guess you had better overcome that difficulty by Monday morning or quit.[5]

If, however, an investigator insists on continuing upon his way through fields of investigation which make no obvious appeal to the patrons unless it be to arouse their spirit of economy, then two courses are open to him. He must either accept a situation which acknowledges that poverty is the patrimony of the Muses or he must find some method of winning the approval of the patrons for his cherished line of research.

In connection with the first of these alternatives, I recall with the greatest pleasure a certain penniless scholar whom I know and greatly admire but whose example I will not recommend for the reason that his mode of life is too ascetic and his privations too severe. Indeed I feel with Burton, that delightful old chatterbox, when he asks in his "Anatomy of Melancholy,"

> What Christian will be so irreligious, as to bring up his son in that course of life [that of the poor scholar] which a beggar's brat taken from the bridge where he sits a-begging, if he knew the inconvenience, had cause to refuse it![6]

If on the other hand the investigator rejects the undowered Muse as a proposition not only personally inconvenient but also incompatible with his own highest efficiency, he must find some way of winning the approval of the patrons. It is here that the privately endowed universities may have some advantage over those which rely on popular support. For in the former pure science may be cherished not only because its more cultured patrons are more appreciative of æsthetic and spiritual values but also because of the affection which their class (the wealthy and leisure class) has for activities, which, because of their apparent uselessness, contribute the more to their social prestige. Such non-material returns are not likely to appeal at once to the patrons of a state university, that is, to the common man, still less to the "hard-headed" (that is, unimaginative) business men who sometimes dominate a board of

[5] R. C. Maclaurin, "Education and Industrial Efficiency," Science, XXXIII., p. 101, 1911. This story I once had the mischievous pleasure of sending to Mr. Allen, of the Wisconsin University Survey, and was complimented by having him write me requesting the exact reference!

[6] Robert Burton, "The Anatomy of Melancholy," Pt. I., Sec. 2, Mem. 3, Subs. 15, 1652.

regents, so that to some vigorous procedure resort must be made.

Offering themselves for our trial or consideration are two such procedures, namely the method of exaggeration and the method of education.

The first of these consists in an effort to make the patron, who in the case of the state university is the common man, feel that the pursuit of pure science will soon and in some way contribute to his physical well-being. Science, it is said, must be cultivated because of its useful application, and so, under the ægis of a useful application of some science or other, the rest of the pure sciences hurry to place themselves, like the acquaintances of a man with an umbrella. The method of exaggeration is in all instances unfair and in the case of the state universities undemocratic. It assumes that the attainment of truth by ourselves is of more importance than its appreciation by the patrons, an assumption which is especially pernicious in the state universities, where the patron is the common man, the people of the state. The method tends to create an intellectual aristocracy on the one hand and a suspicious commonalty on the other. It is a hard saying that those who believe they are investigating purely for "the glory of God and the benefit of man's estate" are often damaging society. But they are when they give to others the material benefits of their labors and keep to themselves the glory of God which has been revealed to them.

But even when we emphatically reject the method of exaggeration and seek to create a real appreciation of the higher values for which the university stands, if, in other words, we set about employing the method of education, even then through force of habit we are very prone to emphasize the lesser and more obvious at the expense of values which, though actually far greater, we consider to be less obtrusive.

As an example in this connection I recall a plea which I once encountered for the study of Latin. The plea consisted in showing the vast numbers of English words having Latin origins. From these data the thoughtless observer was expected to infer a great practical advantage in learning Latin! The common man is quite susceptible to a better and truer argument. He is quite ready to admit the value to the Chinese of a familiarity with our culture; it is not difficult to persuade him that he too might derive much benefit from a knowledge of the culture of the Chinese; it is but a small step from a people living to-day to a people who lived long ago, but who possessed a remarkable culture; and having gone so far, is the common man likely to balk when he finds that the language should not be separated from the literature, the art and institutions of this interesting and instructive people? The common man will admit the advantage of seeing himself as others see him, of viewing our own times and institutions as one freshly arrived from Mars. But such an advantage is possible only to those who have acquired a second culture, that of another race or of another time, in the light of which our times can be less naïvely regarded.

Be it reiterated, then, that we intellectual aristocrats are only too prone to lower our tone to the supposed level of the common man. We should rather encourage him to demand that what he does not understand be made at least partly intelligible to him and we should ever stand ready to disclose our real motives and to share with him our real joys.

In the informal and personal application of this method of education of the common man, the patron of the state university,

we must rely upon the endeavors of those who are in touch not only with the common man but also with the university, who from their origin can sympathize with the one, while by their training they can appreciate the other. I refer to our college graduates. Let these men and women go forth and teach that the benefits which science confers are not only of a material but also of a spiritual character, and that it only remains for the common man to claim the enjoyment of the second as he has already appropriated the first to his use; furthermore that although these benefits are the sole claim which the investigator has upon the patronage of the common man, still these benefits will suffer if made the sole object of impatient search.

It should also be made clear that in many cases, I can not say how many, the value of research is not only measured by what it contributes to science but by what it contributes to the investigator. The theses which our undergraduate students write are in many cases wholly untrustworthy. He must repeat their work step by step before the careful contributor dare present it to a scientific periodical and yet who can doubt the effectiveness of thesis writing as an educational exercise. It is the same with members of a faculty. It is a hard saying, but I believe it is true, that many of our productions achieved with care and accuracy are too insignificant to justify the time expended on them were we to exclude their benefits to the investigator. The patrons need not feel obliged to support such research unless it be performed by one who is at the same time a teacher. In the latter case his researches may be regarded as a most important preparation for his daily task of instructing others. It is only when one devotes his entire time to research that the intrinsic value of those researches demands the serious attention of those concerned with economical administration.

Unfortunately for the spread of our gospel of culture there is a large element in our population which is not likely to be touched by any of our appeals. People who have not enough to eat or to wear, who have been made stupid or angry through economic pressure, do not wax enthusiastic over the rings of Saturn, the origin of the heart beat or the structure of snow crystals. Before this class can become sympathetic with the search for truth regardless of its material usefulness, there must be a considerable modification in the economic structure of society. For such a modification the extension of our ideals in this direction must wait. If it be deprecatingly asked if this is not a subtle endorsement of the doctrine of economic determinism, it may be replied that it means nothing more nor less than the similar affirmation that "Food will win the War."

Having discussed at some length the pursuit of truth and the limitations which are imposed upon it, let us turn from the activity of the university to the second category in which its ideals are manifested, that is, as stated in the beginning of this address, to the ideal attitude. The university attitude is characterized by being critical or rather agnostic and universal, and these we shall discuss in turn.

The terms agnostic and agnosticism have been used in so many ways that many persons have entirely lost sight of their real and original meanings. The word "agnosticism" has been used in theology to designate the inability of finite man to comprehend an infinite God; it has been used in philosophy to describe the impossibility of the mind to know reality, the "Ding an Sich"; it has been used by popular controversialists as a synonym of infidelity. I

now use it in its original sense, the sense given it by the scientist who first coined the term, and if it be necessary to add to it a distinctive adjective to rid it of any ambiguity or invidious implications, it might be called "scientific agnosticism." It is this attribute of scientific agnosticism which is the characteristic of the ideal university attitude.

The agnostic attitude is doubtless as old as human intelligence. This it is which prompts us to cry like Othello

> . . . Give me ocular proof
> Make me to see 't; or, at least so prove it
> That the probation bear no hinge nor loop
> To hang a doubt on.[7]

Alas that Othello should have been so easily satisfied! It is, however, to men of the generation of Tyndall and Huxley that we owe most for the popular exposition of this attitude. The latter, who, by the way, first coined the word "agnostic," points out that this attitude consists in the acceptance of a principle which is as much ethical as intellectual, that it is wrong to affirm as certain that for which we can not produce evidence which may logically justify that certainty. He then continues:

> The results of the working out of this principle will vary according to individual knowledge and capacity, and according to the general condition of science. That which is unproven to-day may be proven by the help of new discoveries to-morrow. The only negative fixed points will be those negations which flow from the demonstrable limitations of our own faculties. And the only obligation accepted is to have the mind always open to conviction.[8]

From this we see that what has been called the agnostic attitude is really a combination of skepticism and openmindedness.

An example will press home this conception more than any number of generalizations and I shall consequently quote from the life of Pasteur an incident which is charmingly illustrative.

When Pasteur claimed to have discovered that the salts of racemic acid consisted of two kinds of crystals, one kind right-handed and turning the plane of polarized light to the right, the other left-handed and turning the plane of polarized light to the left, a discovery of extraordinary importance, the veteran chemist Biot, then seventy-four years old, showed some skepticism. Holding his head on one side, speaking very slowly and smiling ironically Biot kept saying to the friend of Pasteur who had communicated these results to him, "Are you quite sure?" "I should like to investigate this young man's results."

Hearing this, Pasteur arranged an interview with Biot at the Collège de France, where the latter resided. There Biot produced a specimen of racemic acid which he himself had proved to have no effect on polarized light. Then under the direction of Pasteur he proceeded to prepare the solution from which the crystals might be obtained. This done, Pasteur was sent away. When the crystals had been deposited from the mother liquor, Pasteur was sent for to demonstrate to Biot the two sorts of crystals. After he had done so Biot said: "So you affirm that your right-handed crystals will deviate the plane of polarized light to the right, and your left-handed ones will deviate it to the left?" "Yes," said Pasteur. "Well, let me do the rest," and Biot was again left to dissolve the two sorts of crystals separately. Soon after this in Pasteur's presence Biot convinced himself that the assertions of the former were correct. Then taking Pasteur by the arm he said: "My dear boy, I have loved Science so much during my life, that this touches my very heart."[9]

[7] Shakespeare, "Othello," Act III., Sc. III.

[8] Thomas H. Huxley, "Collected Essays," V., pp. 245–246, 1897.

[9] René Vallery-Radot, "Life of Pasteur," pp. 40–41, 1906.

There are times, however, when we find that skepticism is not combined with openmindedness. Many a great advance in science has been greeted with a storm of ridicule or abuse by skeptics with closed minds. Of Van't Hoff they cried: "See this young man fly his Pegasus borrowed, no doubt, from the stalls of the veterinary college where he is a professor!" So it was with Semmelweis and Oliver Wendell Holmes, the discoverers of the infectious nature of child-bed fever, and so also with Darwin and a host of others.

"We used to debate the Darwinian Hypothesis privately," writes Professor Shaler of the time when he was a pupil of Agassiz, "for to be caught at it was as it is for the faithful to be detected in a careful study of a heresy. We had both read the 'Vestiges of the Natural History of Creation,' Lamarck's 'Philosophie Zoologique,' and first the Darwin-Wallace papers and then the newly published 'Origin of Species.' Agassiz had given a large part of his lectures in one term to denouncing these works and to the assertion that species were absolute creations. He never even suggested how the special creation came about, and when, at the end of a lecture, I pressed him for some conception of how a species first appeared, he stated that it was a 'thought of God!' "[10] An answer which, though it may be true philosophically, is biologically speaking quite irrelevant!

This fact, that skepticism is so often divorced from openmindedness, limits greatly the influence of the university upon the common man. The common man has discovered in the universities not only the agnostic attitude but also this counterfeit which he improperly calls "conservatism." This is an unfortunate use of a good word and leads us into endless ambiguities. "Conservatism" is the sentiment which seeks to preserve all that is truest and best both in the present and in antiquity. When on mature consideration we have decided what is best, it is conservatism which directs us reverently to cherish it. But the counterfeit which the common man has detected is the mind which, though skeptical, is tightly closed, it is the mind that believes that that which is, is best and, in refusing to sanction any novelty, claims to be exhibiting the agnostic attitude. This attitude, when it is not actually assumed for selfish motives, is an indication of precocious mental senility, of mental inflexibility or calcification. Its presence is always obstructive; its appearance is always ugly. It may lead a thoughtful nature to such outbreaks of exasperation as we find in the play of Faust:

By that I know the learned lord you are!
What you don't touch, is lying leagues afar;
What you don't grasp is wholely lost to you;
What you don't reckon think you can't be true;
What you don't weigh, it has no weight, alas!
What you don't coin, you're sure it will not pass.[11]

It is a great misfortune that there is as yet no adequate way for the common man to distinguish the genuine agnostic attitude from this counterfeit, for it is owing to the discovery that such a counterfeit exists that the universities have been viewed for years with suspicion by many thoughtful members of society, especially of the intelligent working class. For in the case of the academician or scientific expert, what common man can distinguish wise caution from dull or self-seeking immobility!

But the old are unable to grasp a new idea; are they then to be condemned to euthanasia by chloroform at sixty years, as has been playfully suggested? By no

[10] Nathaniel S. Shaler, "Autobiography," p. 128. 1909.

[11] Goethe, "Faust," Pt. II., Act I., Sc. II., Bayard Taylor's translation.

means. Symmetrical old age is beautiful, not ugly. For along with slowness to grasp new ideas, there is increase in toleration and in benevolence. The growth of the mind has given place to growth of the heart and so "the best is yet to be." It is asymmetrical old age which is ugly. It is mental rigidity without spiritual growth which, like old-sightedness in the young, is so much to be regretted.

The scientific attitude is not only agnostic but also universal. To the scientific mind there are no isolated facts or discrete phenomena, but all are integral parts of the great structure of knowledge. To him the separate sciences and subsciences become of importance and significance only as he sees them as elements of more comprehensive units, which in turn make up the ultimate unit which he calls Nature, Weltanschauung or world picture.

In his "Nature of Truth" Joachim shows how such bald statements as "Cæsar crossed the Rubicon," "This tree is green," or "A whale is a mammal," represent not only a minimal degree of truth but possess no importance nor significance whatsoever. To be fully cognizant of the meaning contained in these statements, one should view each in its proper "setting." But what is to limit the indefinite expansion of this setting? Nothing. And it is a fact which need only be expressed to be grasped that none of these apparently simple statements can be *completely* comprehended except by a mind which is omniscient.[12]

Or again if I say "This is a lead pencil" the meaning of my remark will depend upon the mind to which it is addressed. To the child the remark will have relatively a small content; to the learned the connotation of the word "lead pencil" will be extraordinarily extensive. The pencil has a chemistry and physics, even an astronomy. It has a manufacture and a manufacturer with his anatomy, physiology and sociology. Nay more, it may be found to form an integral part of art and ethics and religion! We are all accustomed to being told that the world of to-day can not be understood without its historical background, but the conception just presented leads one step further and we may add no fact is *completely* intelligible or significant except when seen against the background of universal knowledge.[13]

This, then, is what is meant by the term "universality" and we ask what limitations are there to this attribute of the scholarly mind? Promptly comes the answer that to demand of the scientist that he should view every fact of nature in the light of omniscience is absurd. Doubtless this is true, but that his thinking should bear some traces of this universality is not too much to expect. His strict attention is naturally di-

[12] Harold H. Joachim, "Nature of Truth," on degree of truth in Chap. III., 1906.

[13] It is most interesting to note in passing how closely this conception of the universal element of the scientific mind parallels Schleiermacher's conception of religious feeling. The religious feeling, says Schleiermacher (Friederich Schleiermacher, "Reden über die Religion," 1799; trans. of John Oman, 1893, entitled "On Religion, Speeches to its Cultural Despisers," 1893) may arise from the contemplation of the universe or of any part of it, of all that lives and moves, all growth and change, all doing and suffering. This then is the immediate cause of the religious feeling, but what is the character of this feeling? It is a "sense of the whole." When he looks at a finite object the religious man sees it not in its discrete individuality but always as a "fragment of the whole." The soul and life of the individual is felt by the religious man to be of significance only because it is a part of the universal soul or life which he calls God. With Schleiermacher the feeling is religion and the whole is God. With the scientist there is an imperfect acquaintance with a whole which is nature. To each the feeling of fragmentariness is an accompaniment of finite impressions.

rected to a particular group of phenomena peculiar to the science of his choice. This group lies in the field of his direct vision, so to speak, but surrounding this lies the field of indirect vision, the field of universal knowledge, where objects are less distinctly seen. Between these two fields there is, as already stated, no logical boundary. To be sure our ideas of universal knowledge must be imperfect and vague for any achievement of universality can be but partial. Yet although we may not possess the mind "which is a mirror or glass, capable of the image of the universal world, and joyful to receive the impressions thereof as the eye joyeth to receive light,"[14] yet some effort so to do must be made as our response to this ideal of universality.

Besides this finiteness of man which limits our universality there is another limitation which when it exists is fortunately more amenable to amelioration. It is a certain reluctance to reflect broadly. We live in an age of enforced and minute specialization. Each one of us is anxious to shine in his chosen sphere but also correspondingly reluctant to appear as a dilettante in any other field. We feel, however much we may regret it, that we have no time for mere culture. Ultimately we may even become like coal miners devoting their lives to sending their laden trucks up to the surface of a world they know not of.

This is of course contrary to what I conceive to be the university ideal, and furthermore it is pedagogically undesirable. For I do not think that it can be denied that students would suffer from contact with men who are wilfully limited in horizon. I say "wilfully" because, to the student, contact with aspiration may be as inspiring as contact with achievement. In an atmosphere of limitation the student becomes a specialist also, not in one field but in several. He may study Latin and sociology and music and physiology and become at least for a time a miniature specialist in each, for between these subjects there are to the student's mind no obvious connection. They form no part of a universal scheme of things. Called on to construct such a scheme he would be as helpless as the ancient geographers who

> in Afric maps
> With savage pictures filled their gaps,
> And o'er unhabitable downs
> Place elephants for want of towns.[15]

At length he is permitted to depart from our institutions of learning, taking with him his compartmental knowledge, the more compartmental the more closely he has devoted himself to his studies, whether prescribed or chosen.

How fond we all are of the quotation that Sophocles "saw life steadily and saw it whole."[16] Our veneration of Sophocles rests upon the fact that from necessarily limited data he made a great synthesis, a great induction, and the example of Sophocles commends itself to us as appropriate to set before aspiring young men. But it may be (and that chiefly through our own fault) that few of our students have ever learned that any synthesis, however crude, is possible, much less that it is expected of them. Should not the student take with him from his alma mater the vision of such a synthesis not as a finite act to be performed but as a process continuing all through his intellectual life and evolving as it goes his picture of truth as he sees it?

Percy M. Dawson
University of Wisconsin

[14] Francis Bacon, "Advancement of Learning," Bk. 1, pgf. 6.

[15] Jonathan Swift, "On Poetry, a Rapsody," pgf. 10, 1733.

[16] Matthew Arnold, "Sonnet to a Friend."

SCIENTIFIC EVENTS

NEW EASTERN NATIONAL FORESTS

PRESIDENT WILSON has issued a proclamation establishing three new national forests in the East—the White Mountain, in Maine and New Hampshire, the Shenandoah, in Virginia and West Virginia, and the Natural Bridge, in Virginia.

Proclaiming the forests is the final step in carrying out the law for building up eastern national forests through the purchase of lands in the mountains. Ever since the law was passed in 1911 the government has been engaged in acquiring lands about the headwaters of the principal rivers, both in New England and in the southern Appalachians. As the lands are bought or contracted for, they are put under administration as "Purchase Areas" pending the time when their accumulation has reached a point justifying the proclamation which gives the lands their final status. The Pisgah National Forest, in North Carolina, and the Alabama National Forest, in Alabama, are the only eastern areas which had received this status before the new proclamations were issued.

The White Mountain National Forest is located in Grafton, Carroll and Coos counties, N. H., and Oxford county, Me. The government has actually taken title to about 267,000 acres and in addition about 124,000 acres more have been approved for purchase, making a total of about 391,000 acres under federal protection. This forest protects in part the watersheds of the Androscoggin, Saco, Connecticut and Ammonoosuc rivers. The White Mountain region has great value not only for the protection of streamflow and the production of timber but also as a public playground.

The Shenandoah National Forest is situated in Rockingham, Augusta, Bath and Highland counties, Va., and Pendleton county, W. Va. The government has acquired to date slightly in excess of 100,000 acres, and an additional area of approximately 65,000 acres has been approved for purchase, making a total of approximately 165,000 acres under federal protection. The forest is for the most part on the watershed of the Shenandoah River and it also protects a portion of the watersheds of the Potomac and the James.

The Natural Bridge National Forest is situated in Rockingham, Nelson, Amherst, Botetourt and Bedford counties, Va. The federal government has actually acquired title to a little over 73,000 acres, and an additional area of approximately 29,000 acres has been approved for purchase. The forest, which protects a portion of the watershed of the James River, does not include the Natural Bridge, but this scenic feature is within three or four miles of the boundary.

ALASKA FISHERY AND FUR PRODUCTS IN 1917

The Fisheries Service Bulletin states that although final figures showing the value of the fishery products of Alaska in 1917 are not yet obtainable, the statistics are practically complete so that a reasonably accurate statement of production can now be made. Compilations indicate that the total value of such products was $51,405,260 in 1917. Of this amount 93 per cent., or $47,778,081, represents the value of the salmon products which consist of 5,947,286 cases of canned salmon, valued at $46,304,090, and 16,347,367 pounds of mild-cured, pickled, dry-salted, fresh and frozen salmon, valued at $1,473,991. The halibut fisheries rank second with an output of products valued at $1,120,226. In the order of production, the herring fisheries come next, with a yield of products valued at $767,729. The value of the cod products was $744,976. Whaling operations returned products worth $653,852. The production of miscellaneous fishery products including clams and other shellfish aggregated $340,396 in value.

This unprecedented yield of fishery products in Alaska at a time when the world is in need of food is called an achievement for which the country may justly feel gratified.

The fur products of Alaska are also of considerable importance and value, as evidenced by the fact that in the year from November 16, 1916, to November 15, 1917, shipments from that territory reached an aggregate value of $1,031,638, exclusive of fur-seal skins and fox skins shipped by the government from the

Pribilof Islands. In the calendar year 1917 the government shipped from the Pribilof Islands fur-seal skins valued at $274,291 and fox skins valued at $35,680.

BOTANICAL ABSTRACTS

A MEETING of editors of botanical publications was held at Pittsburgh, on December 28, 1917, to consider the desirability of undertaking the publication of an abstracting journal for botany. After a long discussion the following resolution was adopted:

Resolved, that we, as a group of botanists interested, invite each botanical society to appoint a committee of two to meet with committees of other societies and with the members of this group to formulate a program for a journal of botanical abstracts, botany to be interpreted in its broadest sense. In case action of any society is delayed, the President and Secretary of such society are invited to represent it. A meeting is called for 10 A.M., December 30, at Parlor 140, Fort Pitt Hotel.

At this augmented meeting of December 30, after informal discussion it was voted that the 26 botanists present proceed to formal organization under the name "Temporary Board of Control of Botanical Abstracts." Donald Reddick was elected chairman and Forrest Shreve secretary. On motion it was voted that the board provide for its perpetuation in the following way:

1. That the following botanical organizations be asked to elect two members each:
   - American Association for the Advancement of Science,
   - American Genetic Association,
   - American Microscopical Society,
   - American Phytopathological Society,
   - American Society of Agronomists,
   - American Society of Naturalists,
   - American Conference of Pharmaceutical Faculties,
   - Botanical Society of America, General Section,
   - Botanical Society of America, Physiological Section,
   - Botanical Society of America, Taxonomic Section,
   - Ecological Society of America,
   - Paleontological Society of America,
   - Society for Horticultural Science,
   - Society of American Bacteriologists,
   - Society of American Foresters.

2. That in the election of members to the Board of Control of Botanical Abstracts each society be asked to name one man for a short term of two years and one man for a long term of four years, and that a member be elected biennially thereafter or as required.

On motion the Temporary Board of Control elected by ballot an Executive Committee of Ten on Organization, to act for one year with power to make arrangements for editorial management and publication. This committee is constituted as follows: J. H. Barnhart, Henry C. Cowles, B. M. Duggar, C. Stuart Gager, R. A. Harper, Burton E. Livingston, F. C. Newcombe, Donald Reddick, C. L. Shear and Forrest Shreve.

The Executive Committee of the Temporary Board of Control selected B. E. Livingston for editor-in-chief and the following as associate editors in charge of the sections as indicated:

Agronomy and Soil Technology, ——— ———,
Bacteriology, H. J. Conn,
Botanical Education, C. Stuart Gager,
Cytology, C. J. Chamberlain,
Ecology and Plant Geography, Henry C. Cowles,
Forestry, Raphael Zon,
Genetics, G. H. Shull,
History, Biography and Bibliography, J. H. Barnhart,
Horticulture, W. H. Chandler,
Morphology, E. W. Sinnott,
Paleobotany, E. W. Berry,
Pathology, Donald Reddick,
Pharmacognosy, Henry Kraemer,
Physiology, B. M. Duggar,
Taxonomy, J. M. Greenman and J. G. Schramm.

It is expected that the work of abstracting will begin at once, with the international literature of the year 1918 and that publication will follow promptly.

SCIENTIFIC NOTES AND NEWS

IN honor of Professor Emeritus John J. Stevenson, who held the chair of geology at New York University from 1871 to the time of his retirement from active service in 1909, the building to be occupied by the Faculty Club has been named Stevenson Hall. It was presented to the university at the commencement exercises on June 3.

DR. ABRAHAM JACOBI, the distinguished New York physician, who is still in active practise, received many congratulations on the celebration of his eighty-eighth birthday, which occurred recently.

THE honorary fellowship of the Royal College of Surgeons in Ireland has been conferred on Major Harvey Cushing, of the United States Medical Service, on leave of absence from Harvard University.

DR. JOEL E. GOLDTHWAIT, director of military orthopedics with the American Expeditionary Force in France, has been made a lieutenant-colonel.

MAJOR ROGER I. LEE, chief medical officer of the Harvard surgical unit which sailed a year ago, has been appointed commanding officer in place of Colonel Patterson.

DR. FRANK D. ADAMS, dean of the faculty of applied science and professor of geology, McGill University, has left for England and France to take up work in connection with the organization of the "Khaki University for Canadian Soldiers Overseas."

MR. H. FOSTER BAIN has been appointed assistant director of the U. S. Bureau of Mines and is in the office of the bureau at Washington.

DR. GEORGE V. N. DEARBORN has been commissioned a first lieutenant in the Medical Reserve Corps.

DR. R. B. TEACHOUT, instructor in psychology in the University of Oregon, has entered the psychological service of the national army and is now stationed at Camp Lewis, American Lake, Washington.

IN accordance with the recommendation of Professor Ruthven, director of the Museum of Zoology of the University of Michigan, Mr. Calvin Goodrich, editor of the *Detroit Journal*, has been appointed to the honorary position of associate curator of Mollusca.

WILLIAM P. STUDDERT has been appointed fishery expert on the steamer *Albatross*.

DR. ROBERT G. CASWELL has resigned as assistant professor of chemistry at Colby College, to accept a position as one of the research chemists for the E. I. du Pont de Nemours Company of Wilmington, Del.

DR. C. H. SHATTUCK, professor of forestry at the University of California in charge of range management, has accepted a position for the summer as technical adviser to the field parties now engaged in classifying the public domain lands of the west, which are now open for settlement under the 640-acre Homestead Act. Four parties are at present being organized in Montana, who will report on the grazing value of large bodies of this land.

S. F. HILDEBRAND, director of the Beaufort Biological Laboratory of the Bureau of Fisheries, is engaged in cooperation with Dr. C. W. Stiles, of the Public Health Service, in the campaign for the control of mosquitoes in the environs of Camp Hancock, near Augusta, Ga.

PROFESSOR HAROLD HEATH, of Stanford University, who has made a number of visits to the seal islands as an assistant of the Bureau of Fisheries, has been engaged to go there this year for the purpose of making special investigations, assisting in the annual census, and advising the agents regarding various matters connected with the animal life on the islands.

THE *Journal* of the American Medical Association states that Dr. Charles W. Young, dean of the Union Medical College, Peking, China, has gone to Shansi, taking with him Dr. Chang of the staff of the college, who has had experience in work with the plague in Tientsin. His mission is educational, and he hopes to persuade the governor of the province to stop traffic on the Hwang-Ho River which flows through Saratsi where pneumonic plague is very prevalent. In one town north of the Great Wall, it is said that 1,000 persons died from the disease in five days.

AT a meeting of the Iron and Steel Institute on May 3 awards of £100 from the Carnegie Research Fund were made to Mr. George Patchin, of London, an associate of the Royal School of Mines, and formerly head of the metallurgical department of Birkbeck College, to enable him to pursue research on "Semi-

steel and its heat treatment"; to Mr. J. N. Kilby, of Sheffield, for research work on "The basic open-hearth process of steel making in all its branches"; to Mr. Samuel L. Hoyt, U. S. A., to enable him to study "The foreign inclusions in steel, their occurrence and identification"; and to Professor J. A. Van den Broek, of the University of Michigan, for research work on "The elastic properties of steel and alloys."

The University of Michigan chapter of Sigma Xi, on May 28, initiated thirty new members, all of whom had been actively engaged in research. Professor A. F. Shull delivered the annual address, on the subject "Heredity and the fate of the warring nations."

Dr. Sidney D. Townley, professor of applied mathematics at Leland Stanford University, gave a lecture before the science club of the University of Oregon on May 13, on the subject "The recent earthquake at San Jacinto, California."

Dr. Martin H. Fischer, Eichberg professor of physiology in the University of Cincinnati, delivered the second Sigma Xi lecture of the 1917–18 series at the University of Missouri on May 15. His subject was "The general physiology of water absorption in the living organism." The lecture was open to the public. Dr. Fischer also lectured to the Medical Society of the University of Missouri on May 16, on "Principles of treatment in nephritis." On the evening of the same day he addressed the Missouri Chapter of Sigma Xi in connection with the annual initiation on "Emulsion chemistry and some of its applications."

It is announced that arrangements have been made for a series of special lectures at Cambridge University for the summer meeting, beginning August 1, when the main subject will be the United States of America. Among the lecturers are Professors George H. Nettleton, Henry S. Canby and Henry A. Bumstead, of Yale; Professor J. W. Cunliffe, of Columbia; Professor Santayana, formerly of Harvard, and Sir William Osler, formerly of Johns Hopkins and now of Oxford.

A national union of scientific workers is being formed in Great Britain. Norman Campbell, the secretary, writes to *Nature:* "There is a general agreement that it is imperative for the best interests of science that those who pursue it should possess greater political and industrial influence. The founders of our union believe that they can attain that influence only by adopting the form of organization which has proved effective in experience. That organization involves the formation of a union including, so far as possible, every professional scientific worker, and governed in a completely 'democratic' fashion. It is such a union that we are trying to form."

We have been requested to state that the book "A Year of Costa Rican Natural History," by A. S. and P. P. Calvert, reviewed in Science for March 1, 1918, was published by the Macmillan Company, New York, 1917.

Knud Rasmussen, the Danish explorer, according to an Exchange Telegraph despatch from Copenhagen, has reached Long's Firth with his Arctic expedition and has charted all the Firths of northern Greenland. Important scientific results, the explorer says, have been attained. Rasmussen and his second Thule expedition left Denmark in April, 1916. Reuter's Copenhagen correspondent transmits a telegram from Rasmussen in which the explorer says his advance was attended with the greatest difficulties. Two companions, Hendrik Olsen and Dr. Wulff, perished. After Olsen's death, says the explorer, "we started on our homeward journey and reached land on August 24, at Cape Agassiz in a bad plight, without provisions, having eaten all the dogs." The explorer says he and his companion walked to Etat, whence they despatched sledges with provisions for the rest of the party, but that the relief arrived too late to save Dr. Wulff.

A medical school for French Africa has been founded at Dakar. This school will be under the authority of the director of the Service de Santé, inspector general of the sanitary and medical services of French West Africa, and will have for its mission the training of native physicians and midwives. The

construction and organization of this school shall be, according to the decree, undertaken at once by the governor general so that the necessary funds will be forthcoming as provided for by this law.

AT the seventeenth annual meeting of the North Carolina Academy of Science, held at Greensboro on April 26 and 27, Dr. E. W. Gudger, after ten years' service as secretary-treasurer, was made president for the next year. The other officers elect are: *vice-president,* Professor H. B. Arbuckle, Davidson College; *secretary-treasurer,* Mr. Bert Cunningham, Trinity College; additional members *executive committee;* Rev. George W. Lay, St. Mary's School; Professor Gertrude W. Mendenhall, State Normal College and Professor J. J. Wolfe, Trinity College.

UNIVERSITY AND EDUCATIONAL NEWS

THE Rockefeller Foundation has made the following appropriations: Howard College, Birmingham, Ala., $100,000; Wake Forest College, Wake Forest, N. C., $100,000, and Meredith College, Raleigh, N. C., $75,000. The board granted $195,000 for state agents for negro rural schools and for the annual maintenance of negro schools in the south. It also appropriated $14,000 for farm demonstration work in Maine and New Hampshire.

AT the University of Kentucky Dr. C. A. Shull, of the University of Kansas, has been appointed head of the department of botany; Dr. C. B. Cornell, of the University of Nebraska, assistant professor of education, and W. D. Funkhauser (Ph.D., Cornell) head of the department of zoology.

AT the University of Chicago, the following promotions have been made: To a professorship, Preston Keyes, anatomy; to associate professorships: Herman I. Schlesinger and Jean Piccard, chemistry; to assistant professorships: Gerald L. Wendt, chemistry; Charles C. Colby, geography, and Morris M. Wells, zoology; to instructorships: Merle C. Coulter, botany; Carl Richard Moore, zoology.

AT the University of Michigan Associate Professor Arthur J. Decker has been promoted to be professor of sanitary engineering. Walter C. Drury has been made instructor in sanitary engineering.

DISCUSSION AND CORRESPONDENCE

ON THE ANTIQUITY OF MAN IN AMERICA

IT is not from choice that the writer again ventures to take part in the controversy regarding the antiquity of man in America, but the reported discovery of remains of man associated with those of fossil animals of Pleistocene age at Vero, Florida, has reopened the question of antiquity and presents such possibilities of erroneous interpretation that I feel impelled to offer a word of caution.

The American aborigines as known to us have occupied every available part of the continent from the Arctic to the Antarctic throughout the long but illy defined period known as the Recent, and their osseous remains and the relics of their handicraft have become associated with unconsolidated superficial deposits by burial, and by the changes, often very profound, which take place everywhere through the action of wind, water and gravity and especially along stream courses; and in the passage of the centuries and millenniums it is patent that the relations of human remains and relics of all classes have been subject not only to minor but often radical changes in their relation to one another and to the original formations and surface of the occupied areas.

The full significance of these conditions is seldom realized or but imperfectly recognized by those who seek the early traces of man's presence and who venture to reckon the period of his arrival. The stream, for example, that meandered a valley or plain thousands of years ago may ere this have rearranged the materials of large areas along its course. Its channel may have worn its way back and forth over miles of territory, yet the formations thus effected may be so reset, though largely at reduced levels, as to obliterate traces of disturbance. Changes in the chronologic rela-

tion of inclusions in sloping and rolling country may have been similarly effected without leaving distinguishable traces. It is the failure to recognize these important considerations that has led in many cases to the confident and regrettable announcements on the part of students respecting the original association of human remains with the remains of fossil animals of the earlier periods.

It is not the Vero evidence, however, which requires particular attention at this time, since the interpretations favoring great antiquity are fully offset by the interpretations of anthropologists of long experience in the consideration of problems of the history of man in the world and the evidence relating thereto, but because questions of wide range have been opened through the revamping by Dr. Hay of a large body of so-called evidence of geological antiquity which has long been discredited and relegated to the historic scrap heap where it should still remain.[1]

There is a peculiar and very strong fascination in the idea of hoary antiquity and on the part of many students a disposition to discover parallels between the early events of human history in the old and new worlds, and the gathering of data bearing on these ideas becomes an obsession. Had certain of our archeologists in past decades not met with strenuous opposition glacial man in America would long ago have been fully "established." We should now have in our museums large collections of American paleolithic implements duplicating in nearly every respect the paleoliths of Europe and no end of bones of Pleistocene man and if now such views as those of Dr. Hay are allowed to prevail we shall have to accept the conclusion that American man had advanced to the pottery-making stage in the middle or early Pleistocene, and that after the lapse of a vast period the art was revived by the same or another people using the same materials, employing similar methods and attaining identical results in the same region—a marvel without parallel in the history of man.

[1] *American Anthropologist* (N. S.), Vol. 20, No. 1.

It is manifestly a serious duty of the archeologist and the historian of man to continue to challenge every reported discovery suggesting the great geological antiquity of the race in America and to expose the dangerous ventures of little experienced or biased students in a field which they have not made fully their own.

Dr. Hay has published a map giving locations of finds of traces of man attributed to the Pleistocene, these in cases being associated more or less intimately with remains of *Elephas imperator*. But this association is open to different interpretations and I feel justified in raising the danger signal in each and every case since, if left alone, lamentable errors may become fixtures on the pages of history. I therefore hasten to relabel the map "Danger Signals for the Student of Human History."

I do not wish for a moment to stand in the way of legitimate conclusions in this or any other field of research, but illegitimate determinations have been insinuating themselves into the sacred confines of science and history with such frequency and persistence that no apology is required for these words of caution.

W. H. Holmes
Department of Anthropology,
U. S. National Museum

NOTE ON SUDAN III

The toxicity of this dye, used so extensively in the study of problems connected with fat metabolism and vital staining, is a question of considerable importance; on this account a preliminary notice is presented of the finding that the preparations now on the market are of very doubtful purity.

Mendel and Daniels once stated that large doses of this dye fed to cats were harmless, provided the dye was pure. A preparation put up by an American manufacturer was given by them in large doses to two cats, which subsequently died within a comparatively short time, apparently from the effect of some impurity in the dye.

Some years later Salant & Bengis in their pharmacological study of fat soluble dyes stated that rabbits fed 1.7 gm. per kilo died in

one to three weeks, but it was extremely doubtful whether death was due to the dye.

Experiments carried out in this laboratory with three German preparations and one of American make show great variation in general physical and chemical properties. Melting points vary by as much as 70 degrees, the color of solutions in oil range from a deep orange to a venous red, and their degree of solubility in neutral, alkaline or acid solutions is not the same.

The impure preparations were found in every case to be highly toxic, causing rabbits to die within 24 hours.

Full details of the completed experiments will be published later.

B. E. READ

YALE UNIVERSITY

SCIENTIFIC BOOKS

Lord Lister. By SIR RICKMAN J. GODLEE, Bart., pp. xix, 6761. Macmillan & Co., Ltd. London. 1917.

This is the biography of a man who never wrote a book yet whose work so profoundly transformed surgery that "Before Lister" and "After Lister" in surgical chronology are the counterparts of B.C. and A.D. in Christian chronology!

As a biography the story is too detailed to be easy perusal for the non-medical reader as compared, for example, with Vallery-Radot's "Pasteur"; but as the authorized biography by Lister's nephew and assistant, who had access to all his letters, remarkable commonplace books and other data, and as a narrative intended to trace the development of Lister's antiseptic system for the enlightenment of the profession in future ages, it is none too long nor too minute. It is more than a biography. It is an important historical document.

Joseph Lister was born a Quaker and continued in the Society of Friends until his marriage with the daughter of his professor of surgery, Mr. Syme, in 1856, when he withdrew from the society and later joined the Episcopal Church in Scotland. In his correspondence with his family, however, he always used the plain language, but in a form which differs from that of our Philadelphia Friends and often grates upon both eye and ear. He simply replaces "you" by "thee," the plural verb being retained, *e. g.,* Thee say, are, have, etc.

He witnessed the first operation ever performed in Great Britain under ether anesthesia by Liston in December, 1846. Yet as Godlee points out it was hard to displace the old slap-dash surgery which was no longer necessary when pain had been abolished. Yet even in my own student days (1860–62), I have seen stop-watches pulled out to time how many seconds were required by Gross and Pancoast to whip a stone out of the bladder.

Lister's first work was in anatomy and pathology, especially in inflammation. Few remember that it was he who in 1853 first demonstrated the circular and the radiating muscular fibers in the iris.

A visit to Edinburgh for observation changed his whole life, for he settled there first as a student, then as an extra-mural lecturer, and there found his model wife whose death in 1893 was such a terrible blow to him.

In 1860 he was appointed regius professor of surgery in Glasgow. The very next year he attributed suppuration not to the oxygen of the air as all the chemists and everybody else were teaching, but to fermentation. His first two papers introducing the antiseptic system were not published until 1867.

Sir Rickman gives an excellent account of the warfare on "hospitalism" and puerperal fever by Simpson, Erichsen and Semmelweiss, but does not even mention our own Holmes, whose finger pointed the way as early as 1843. The echoes of his battle royal with Meigs and Hodge, of Philadelphia, were still reverberating when I was pursuing my medical studies. The methods of treatment of wounds which I was taught, and which I practised during the Civil War and down to 1876, are well described. Then follows a discussion of fermentation and putrefaction, and next the history of the rise and progress of Lister's antiseptic system, its modifications and its eventual triumph.

The "Story of the Four Flasks," which became, as Godlee well says, "classical," is finally completely told. These were partly filled with fresh urine, boiled, their necks drawn out to 1/12th of an inch in diameter and all left open to the air. The neck of one was left vertical, those of the other three were bent downward. The contents of the vertical necked flask soon putrified. The other three travelled with him from Glasgow to Edinburgh and thence to London, where they were accidentally destroyed by fire *ten years* after being prepared as described. During all these ten years the urine remained clear and undecomposed! If for ten years, why not undecomposed for a century!

The two chapters describing the reception of Lister's antiseptic system by the profession "at home" and "abroad" are most interesting. After nine years in Glasgow, Lister succeeded Syme in the chair of clinical surgery in Edinburgh, where his success as a teacher was as immediate as it had been in Glasgow, where he had "taken the students by storm." Here he created a school of enthusiastic pupils who in time won hospital positions as didactic and clinical teachers and practised antisepsis.

In 1877, at the age of fifty, he went to London to King's College as the successor of Sir William Fergusson, who had been easily and for long the foremost surgeon of the metropolis. But what a contrast! What a chilling frost! Instead of over 180 as at Edinburgh, the number of new students annually was less than 25! At his lectures the present distinguished surgeon, Sir Watson Cheyne, —one of four assistants who had gone with Lister from Edinburgh to London, as he had stipulated—was careful to attend, so that at least there might be a dozen auditors! "We four unhappy men . . . wandered about . . . the wards in other hospitals where the air was heavy with the odor of suppuration . . . and the flushed cheek spoke eloquently of surgical fever." In Edinburgh Lister had had "half a dozen wards with 60 or 70 patients" whereas at King's he had "only two wards . . . but only *empty beds*"! The extraordinary domineering conduct of the nurses at King's will seem very strange to American surgeons and nurses.

In the London medical societies discussions on antisepsis were either listless or else hostile. Most of the surgeons did not really grasp the fundamentals of the system. Even Paget dressed a compound fracture of the leg by putting on collodion *at once* and then *12 hours later* applied carbolic acid! Yet he declared that the treatment "did no good" though he had taken "special care" to follow Lister's method! Mr. Savory, one of the leaders and surgeon to "Bart's" itself, in 1879 considered that an annual average of about 6 cases of pyemia, 20 of erysipelas and 26 of blood poisoning represented as good a result as it was reasonably possible to expect!

In 1876 in connection with the Centennial in Philadelphia, we held an International Surgical Congress. There I saw, heard and met Lister for the first time. The general tone of the discussion in the surgical section of which Lister was chairman, with the exception of a few, was that the system was little if anything more than "surgical cleanliness"! I was an attentive listener, was wholly converted to Lister's views and began to practise his method when I went on duty at St. Mary's Hospital, October 1, 1876, and have never for a moment ceased to be an enthusiastic disciple. My results were marvellously different from what they had been in the same hospital for ten years. "Experientia docet." I *know* whereof I speak by bitter prior experience.

On the Continent, Saxtorph, Thiersch, Volkmann, Nussbaum, Championnière and others very early accepted the method and improved it. Then it came back re-vamped as it were to London, and finally, has won its way in a triumphant progress all over the civilized world.

Honors had begun to come thick and fast. The presidency of the Royal Society, degrees and honorary memberships from everywhere, a baronetcy and finally the peerage and the Order of Merit, limited to 24, and Lister was one of the first 12.

Then alas came the declining day with loss of physical and at last of mental vigor and finally the last closing of the eyes and a tablet in the Abbey.

Lister lived too long. It is better that every man should go before declining powers betray him. Strange to say both he and, if one may judge from various hints, his biographer also are disposed to be *laudatores temporis acti*, and mourn what seems to me a natural and inevitable development from antisepsis to asepsis, but which they regard as "a heresy."

So far from Lister's "practise having been discarded and his theory exploded" they have never been so firmly entrenched as now. Asepsis well suits civil practise in "clean" cases, but not in deeply infected cases. The Great War has recalled us to antisepsis, by reason of the intensity of its infections. The Carrel-Dakin method employs better antiseptics than carbolic and better methods of disinfection than Lister ever knew. The bacteriologist and the surgeon working together determine when a wound may be closed with assurance of success. Moreover if we can treat contaminated wounds early, before the bacteria have penetrated deeply and remove all the devitalized tissue and on and in it the great majority of the bacteria, the phagocytes can care for the remaining mild infection. Immediate closure may then be made.

It has remained for a non-medical snarling Irish critic, whose colossal egotism will readily suggest his name, and an anonymous medical reviewer both in the *Nation* (London) and another writer in the English *Review* whose article I have not seen, to belittle Lister and declare that he was not a great man.

With me the opinion of such judges as Volkmann, Virchow, Pasteur, Weir Mitchell and Lord Kelvin and the homage of thousands at the Great Congresses in London, Amsterdam, Philadelphia, Berlin, Montreal and elsewhere are enough. His detractors will have their day and cease to be, but "Humanity with uncovered head will salute" the Great Benefactor.

Is not my opening sentence correct?

Of course I had expected the superfluous "U" (a sort of intruding philological U-boat) in "tumour, labour," etc., although the Latin originals of all such words have no "u." Even the N. O. D. has "actor, also actour"! I must confess to surprise when I found the archaic "plaister" (which the N. O. D.) prints but marks "obsolete") especially as Lister himself wrote "plaster." W. W. KEEN

NOTES ON METEOROLOGY AND CLIMATOLOGY

THE "OLD-FASHIONED" WINTER OF 1917-1918[1]

EVEN though summer is upon us, it is not difficult to recall that last winter in the United States east of the Rockies was remarkably cold and snowy. The first killing frosts of autumn came early, and nipped crops which had started late and grown slowly in the cold spring and early summer. The South had a real winter, much to the detriment of fruit and truck crops which were caught by frost. By far the most intense winter conditions occurred in the regions from the Ozarks to New England, where low temperatures brought snow with passing cyclones, and the snow-cover in turn cooled the air excessively whenever the sky was clear. The unprecedented snow and ice blockades brought the well-known, long chain of uncomfortable and costly results.

In the eastern United States it was not surprising that autumn months which in many regions were the coldest on record, should be followed by a December and a January that defied the memories of the oldest inhabitants. For example, in Ohio, a 64-year record fails to show a colder December, and in New England, January seems to have been the coldest month at least since 1836, if an Amherst record may be considered as representative. In these cold months, new minimum temperatures were established broadcast. Early in December, for instance, temperatures as low as 20° to 31° below zero (F.) were observed

[1] A more extensive account is to be found in the *Geographical Review*, May, 1918, Vol. 5. This is based essentially on serial publications of the Weather Bureau, and on some press reports.

from western Tennessee to southern Ohio where the snow was deep at the time. One Weather Bureau observer in West Virginia reported a minimum of —37° F.; and another in Iowa, —40°. Extreme minima, —45° F., established new low records for South Dakota and Maine. On January 12, "that cold Saturday," a true blizzard with snow driven by a gale at a temperature down to 20° below zero (F.) tied up traffic almost completely for two days in the Middle West.

Relative to the cold land or snow surfaces, the open waters of the Great Lakes, Atlantic and Gulf were excessively warm; therefore they favored the development of numerous cyclones—some of them very intense. These supplied the snow which blockaded the railroads, or the rain which produced such disastrous floods in the ice-gorged rivers.[2] In the immediate vicinity of the Great Lakes, snow fell almost daily in January; and with many heavy falls, reached totals of 3 to 5 feet in that month alone. Chicago with 42 inches and Milwaukee with 53, saw the worst snow conditions in their histories. Farther south, in a belt from the Ozarks to the upper Ohio River, equally large amounts of snow were precipitated in January by the cyclones passing on the south, around the edge of the cold snow blanket. October and December were snowier than usual, especially December, in much of the eastern half of the country.

The weather was extraordinary not alone in the eastern United States: west of the Rockies the winter was one of the warmest on record. Extreme dryness prevailed in the southwest; but extraordinary rainfall occurred in the northwest. In December a temperature of 86° below zero (F.) was reported from the Upper Yukon, at the mouth of the Pelly River. If authentic, this established a record for North America which is only 4° (F.) below the earth's extreme surface minimum —68° C. (—90.4° F.), observed in Siberia in 1892.[3] Northern Sweden at about the same time had unprecedented coldness —57° C. (—70.6° F.) at Asele, and reports from Spain, central plateau of France and southwestern Asia tell of a winter of extreme severity.

Why is the world having such unusual weather? This is a period of sun-spot maximum—a time when solar radiation comes to its maximum; a condition occurring on the average once in 11 years.[4] Experience has shown that at such times there is a general tendency in winter to strong continental anticyclones and ocean cyclones; with corresponding storminess and coolness.[5] For North America, a strong winter anticyclone generally seems to favor coldness in the east and warmth in the west.[6] Locally, the snowiest and coldest weather occurs where, in spite of low temperatures, the supply of moisture is abundant and the temperature contrasts produce the storminess requisite to precipitate it as snow. Then this snow keeps the air cold and helps to make more snow; until important changes in general winds dominate the weather and eliminate the snow-cover—as was the case early in February, 1918. While the present degree of solar activity lasts, further occurrences of extreme weather are not unlikely.

Meteorology in the Army and Navy

Since weather has much to do with military operations, especially flying,[7] it was natural that before one month had passed after the entry of the United States into the war, instructors had been sent to the flying school at Toronto for preparation to teach meteorology at the six new aviation ground schools in the United States. This work has progressed quietly ever since. Professor R. DeC. Ward,

[2] See *Mo. Weather Rev.*, Feb., 1918.

[3] See note, "The Lowest Air Temperature at a Meteorological Station," *Mo. Weather Rev.*, Vol. 45, 1917, pp. 407–408.

[4] For a further discussion, see C. G. Abbot, "The Sun and the Weather," *The Scientific Monthly*, Vol. 5, Nov., 1917, pp. 400–410.

[5] *Cf.* H. Arctowski, *Bull. Am. Geog. Soc.*, 1916, Vol. 42, pp. 270–282.

[6] See T. A. Blair, "Some Temperature Correlations in the United States," *Mo. Weather Review*, Vol. 45, 1917, pp. 444–450.

[7] *Cf.* R. DeC. Ward's most recent articles, *Scientific Monthly*, February and April, 1918; and in *Jour. of Geography.*

the instructor in aeronautical meteorology at the U. S. Army School of Military Aeronautics at the Massachusetts Institute of Technology, has published a syllabus of his course of ten lectures,[8] and also the essentials of these ten as condensed into three lectures.[9] This presentation of "Meteorology and War-Flying" gives the essence of what the aviator needs to know, and contains full references to this rapidly developing application of meteorology. Major (formerly Professor) Wm. R. Blair has prepared a report on "Meteorology and Aeronautics,"[10] the purpose of which is "to show the sort of atmospheric data available and to put the subject in such shape as may make it bear directly on the problems which are met in aviation."

While the aviators were being trained, the Signal Corps was establishing its meteorological service abroad. As the first contingents of the American Army went overseas, Majors W. R. Blair and E. H. Bowie, appointed respectively from the aerological and forecasting divisions of the Weather Bureau, were put in charge of the meteorological work. In November those responding to a call for a large number of meteorologists were given a period of intensive training at more than a score of Weather Bureau stations. Professor W. J. Humphreys's new book, "The Physics of the Air," which is being published in the *Journal of the Franklin Institute,* was of great help to the more advanced students. This work is a highly valuable contribution to the science, for it covers the fundamentals of meteorology in such a way that it can be used readily as an advanced text-book.

More meteorologists are needed. So a Signal Corps School of Meteorology has been established at College Station, Texas. Here over 300 meteorologists, physicists, engineers and other technical specialists are about to begin an 8-week course in meteorology. Dr. Oliver L. Fassig, from the Weather Bureau at Baltimore and Johns Hopkins University, is chief instructor. There are to be three assistant instructors: Mr. W. T. Lathrop, from the Weather Bureau at Greenville, S. C., for instruments, observations and map-making; Lieutenant Wm. S. Bowen, for the aerological work; and Dr. C. F. Brooks, from Yale University, for the course in general meteorology. About thirty of the Weather Bureau men in the school will also assist in instruction.

In addition to this training of specialists—and perhaps induced thereby—are the short courses in meteorology included in the military instruction of the Reserve Officers Training Corps in many universities.

Meteorology in the navy has been developed by Lieutenant Commander Alexander McAdie, in charge of the aerographic section, and trained men are in service overseas and in this country. A school for men taking up this work is maintained at Blue Hill Meteorological Observatory under the guidance of L. A. Wells, chief observer and forecaster of the observatory.

Naval training units at the universities, are now, or will soon be, receiving instruction in marine meteorology.

The importance of meteorology has never before received such wide recognition, and in view of the permanent development of aeronautics, it seems safe to predict that hereafter it will always hold a more important position in the curricula of the universities.

CHARLES F. BROOKS
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[8] SCIENCE, July 27, 1917, Vol. 46, N. S., pp. 84–85.

[9] *Mo. Weather Rev.*, Washington, December, 1917, Vol. 45, pp. 591–600.

[10] Report No. 13, 1917, National Advisory Committee for Aeronautics, Washington, D. C.

SPECIAL ARTICLES

CONCERNING SELECTIVE PERMEABILITY

IN most cases in living organisms, cell permeability does not even seem to violate the known physico-chemical laws. There are, however, several exceptions, notably in the intestines and kidneys, where the permeability is selective.

In considering the membranes that seem to disturb osmotic laws, it is often stated that they cause these disturbances because the

membranes are living, as though that were sufficient explanation. Are not the membranes that do obey the laws living, too? Those membranes through which certain substances can pass from a lower to a higher concentration are very probably different from the membranes used in experimental work. It is only by assuming that the membrane plays an active part in determining this one-sided permeability that the thermodyamic laws are brought into question. The sieve theory, even when so modified as to render negative osmosis[1] available, does not seem convincing. No gradation of molecules in the membrane, either of concentration or kind, allowing the solute to pass from one molecule to another, could possibly explain the facts. Nor does the theory of the funnel-like arrangement of lipin molecules,[2] ingenious though it be, allay one's curiosity. However, there is no doubt that most of the recent ideas on this question have been correct in postulating structures as a necessity in any explanation of this elusive (vitalistic) phenomenon.

Wherever selective permeability occurs there is at least one layer of cells through which the solute has to pass. It is inconceivable that if all parts of these cells were exactly alike there would be selective action. But there seems to be no theoretical difficulty provided certain differences exist. The two membranes in contact with the two fluids need to be different. The substance under consideration easily passes the membrane on the entering side of the cell, but passes either not at all, or with great difficulty the membrane on the exit side of the cell. In the cell a chemical change occurs in the substance that has entered. After this change it can pass the second membrane easily, but passes only with difficulty the membrane by which it gained entrance.

It is not necessary to assume a profound change to make conditions favorable for this differential solubility. But it is necessary that the substance formed should exist in higher concentration than the original substance when the two are in equilibrium. A change from an alkaline to a neutral or acid medium, involving a change from a sodium salt to the free compound or to, say, the chloride would be sufficient, or a synthesis of the entering compounds to more complex ones would suffice to make the theory plausible.

Because of our ignorance of just what happens in these membranes and cells, it can not be stated with certainty that specific changes do occur in a substance on passing through the cells and membranes. But the conditions necessary for such chemical and physical alterations seem to exist. The probabilities in this hypothesis can be more readily appreciated by taking an example.

The fats are hydrolyzed in the intestines to the sodium soaps. These sodium soaps, but not the fats, are able to pass the intestinal wall membrane. On entering the cell space inside the wall, the soaps are not free to pass on to the lymph or blood, because of the comparative impermeability of the second membrane to the soaps. While between these two membranes the soaps are synthesized to fats by the aid of enzymes in the presence of glycerol. Now these fats are able to pass through the second membrane to the lymph or blood; but the membrane on the intestinal side is comparatively impermeable to the fats. It is thus evident that there is reason for much higher concentration of fat in the lymph than in the intestines.

Though this illustration was chosen because it fits the theory, there is no inherent reason why the same conditions should not apply, say, to the absorption of the amino acids. They may be absorbed by intestinal cells as the sodium salts, then be changed to free amino acids, and pass thus to the blood. It is not necessary to assume that the compound exists in the same form in the blood as in the intestinal cell. It may change to any conceivable compound after passing the second membrane, may even change back to the one that passed the first membrane. There is more difficulty in accounting for the selective permeability of membrane cells in the case of rather

[1] F. E. Bartell, *J. Am. Chem. Soc.*, 36, 646 (1914).

[2] T. B. Robertson, Science, 45, 567 (1917).

inert chemical substances, such as the passage of sugars through the intestines or of urea through the kidney. But no decided changes in the molecules seem necessary. The conditions in the membrane cells may be favorable for weakly combined synthetic derivatives with the right solubilities. When we realize how susceptible to small differences in salts the membranes are, it is not impossible that some particular salt of the passing substance may be all that is necessary to determine its ready exit. If all other ideas fail in any given case, one can always fall back on the ever-ready help of the all-pervasive enzyme.

Several other writers have stated that these selective membranes behave as though a genie stood at the opening in the membrane, allowing the molecules from the side of lower concentration to pass, while closing the door to those moving in the opposite direction. It is evident that a space in which the proper chemical reaction occurs, and which is situated between the two different membranes with the proper permeabilities, functions like our anthropomorphic genie.

It is rather apparent that the idea outlined above is about half way between that of ordinary permeability and secretion. Though it does have many points in common with secretion, it seems wise not to confuse the two; for it is clear that they are different in the purpose served as well as in the method of obtaining their results.

If the attention is confined to the isolated system, solution one, the cell membrane as a whole, and solution two with concentration greater than solution one, the law of the conservation of energy is not obeyed. This might be urged as evidence of vitalism. But closer scrutiny will show that the necessary energy to run this system comes from outside. The substance necessary for the chemical reaction has to be formed and sent to the proper place. If this substance is derived from solution *two* directly, energy equivalent to that produced in the combination must be supplied to dissociate the complex. And energy is necessary to transport this substance back again to the permeability cell. Energy is also consumed in maintaining the cell structure. Even in a living organism one hesitates to start a perpetual motion theory, partly because it is such a lazy way of settling a difficulty, and partly because it would necessitate a later disillusionment.

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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION B

THE section convened at Pittsburgh at 10 A.M., December 27, 1917, in Room 209 of the School of Applied Science, Carnegie Institute of Technology. Its sessions, jointly with those of the American Physical Society, extended over a period of three days. The scientific papers presented under the auspices of the American Physical Society are as follows:

"The optical properties of rubidium," by J. B. Nathanson, Carnegie Institute of Technology.

"A preliminary study of the luminescence of the uranyl salts under cathode ray excitation," by Frances G. Wick, Vassar College, and Louise S. McDowell, Wellesley College.

"Note on a phosphorescent calcite," by E. L. Nichols and H. L. Howes, Cornell University.

"The visibility of radiation in the blue end of the visible spectrum," by L. W. Hartman, University of Nevada (communicated from the Nela Research Laboratory, Cleveland).

"An improved form of mercury vapor air pump," by Chas. T. Knipp, University of Illinois.

"Heat conductivity of cerium," by C. N. Wenrich and G. G. Becknell, University of Pittsburgh.

"Temperature and heat of fusion," by J. E. Siebel, Chicago.

"Report on the construction of certain mathematical tables," by C. E. Van Orstrand, U. S. Geological Survey, Washington, D. C.

"Mobilities of ions in vapors," by Kia-Lok Yen, University of Chicago.

"The size and shape of the electron," by Arthur H. Compton, Westinghouse Lamp Company.

"The coefficient of emission and absorption of photo-electrons from platinum and silver," by Otto Stuhlmann, Jr., University of Pennsylvania.

"Ionization and excitation of radiation by electron impact in nitrogen," by Bergen Davis and F. S. Goucher, Columbia University.

"Energy in continuous X-ray spectra," by C. T. Ulrey, Columbia University.

"An experimental investigation of the characteristic X-ray emission from molybdenum and palladium," by Benjamin A. Wooten, Columbia University.

"Characteristic X-ray emission as a function of the applied voltage," by Bergen Davis, Columbia University.

"A standard of sound" (demonstration), by Chas. T. Knipp, University of Illinois.

"The air damped vibrating system: theoretical calibration of the condenser transmitter," by I. B. Crandall, American Telegraph and Telephone Company and The Western Electric Company.

"A photographic method of measuring the velocity of sound waves near the source of sound," by Arthur L. Foley, Indiana University.

"The effect of intensity and distance on the velocity of sound," by Arthur L. Foley, Indiana University.

"The influence of the pressure and time employed in condensing a dental amalgam upon its crushing strength, at temperatures between 10° and 100° C.," by Arthur W. Gray and Paris T. Carlisle, The L. D. Caulk Company.

"Absorption in paraffined paper condensers," by L. Pyle, Washington University, St. Louis.

"An interesting case of resonance in an alternating current circuit," by H. L. Dodge, The State University of Iowa.

"On electromagnetic induction and relative motion II.," by S. J. Barnett, Ohio State University.

"Eddy-current and hysteresis losses in iron at high frequencies," by C. Nusbaum, Harvard University.

"Some energy transformations with oscillatory currents," by E. F. Northrup, Princeton University.

"The effects produced upon audion characteristic curves by different kinds of signals (Buzzer Electron Relay and 60-cycle A. C.)," by A. D. Cole, Ohio State University.

"Influence of a series spark on the direct current corona," by S. F. Crooker, University of Illinois.

"On the effect of a magnetic field upon cathode rays," by L. T. More and Lowell M. Alexander, University of Cincinnati.

"The physical characteristics of X-ray fluorescent intensifying screens," by Millard B. Hodgson, Eastman Kodak Company.

"Barometric ripples," by W. J. Humphreys, U. S. Weather Bureau, Washington, D. C.

"The ultra-violet and visible absorption spectra of phenolphthaleins," by W. E. Howe and K. S. Gibson, Cornell University.

"The ultra-violet and visible absorption spectra of Orcinolphthaleins," by R. C. Gibbs, H. E. Howe and E. P. T. Tyndall, Cornell University.

"The ultra-violet absorption spectra of acetone," by E. P. T. Tyndall, Cornell University.

"Thermal conductivity of metals," by Edwin H. Hall, Harvard University.

"A mercury manometer of high sensibility," by J. E. Shrader, Westinghouse Research Laboratory, Pittsburgh.

"A simple gauge for very low pressures," by J. E. Shrader, Westinghouse Research Laboratory, Pittsburgh.

"Resonance and ionizing potentials for electrons in magnesium vapor," by P. D. Foote and F. L. Mohler, Bureau of Standards.

"The spectral photoelectric sensitivity of molybdenite," by W. W. Coblentz and W. B. Long, Bureau of Standards.

The papers by Messrs. Siebel, Foley, Crooker, More, Alexander and Coblentz were read by title.

On Saturday morning, December 29, at 10 A.M. the subject of discussion was "The relationship of physics to war." Addresses were made by Lieutenant G. P. Thomson, R.F.C., and by Lieutenant Giorgio Abetti, member of the Italian Military Mission. Informal reports upon the war activities of various laboratories were made by the following representatives:

Dr. A. L. Day, director of the Geophysical Laboratory.

Dr. I. B. Crandall, Research Laboratory of the Western Electric Company.

Dr. Frank Wenner, Bureau of Standards.

Mr. C. E. Skinner, Research Laboratory of the Westinghouse Manufacturing Company.

Dr. W. J. Humphreys, U. S. Weather Bureau.

The Sectional Committee announced the appointment of Professor C. T. Knipp, of the University of Illinois, to fill the vacancy on the sectional committee made by the withdrawal of G. W. Stewart.

The Section elected by ballot the following named persons:

For member of the Council: Professor Wm. Duane, of Harvard University.

For member of the Sectional Committee: Dr. H. D. Arnold, of the Research Laboratory of the Western Electric Company.

For member of the General Committee: Dr. H. S. Hower, Carnegie Institute of Technology.

G. W. Stewart,
Secretary